

## PHENOMENA, DRIVING QUESTIONS AND SEPUP STORYLINE

## CHEMISTRY OF MATERIALS

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**Unit Issue:** Properties of materials determine their uses and effect on the environment.

**Anchoring Phenomenon:** Different materials are used for different purposes. Examples explored include properties of plastic, glass, and metal drink containers and water bottles, and the varied properties and uses of plastics in thousands of everyday objects. Students generate and answer questions such as: How do the particle structures of materials vary? How do these structures determine the properties of materials? How do the properties of materials affect their usefulness and impact on the environment?

Investigative Phenomena	Driving Questions	Guiding Questions	Activities	PE	Storyline	
Materials like plastics, metals, and glass are all useful, but they can also affect the environment.	How do a material's properties affect its uses?	What information would help you decide which material is best for making a single-use drink container? (Activity 1)	1, 2, 3, 4, 5	MS-PS1-3	Materials for drink containers introduce the properties, production, and wastes for three materials, and introduce advantages and disadvantages of using materials for various purposes.	
		How can scientists use physical properties to identify elements? (Activity 2)				All materials are made from a limited number of elements (each having characteristic properties and atoms).
		How do the properties of materials determine their uses? (Activity 3)				Properties such as color, solubility, density, and melting and boiling point determine the uses of materials.
		How can you use the mass and volume of an object to calculate its density? (Activity 4)				A substance's density can be calculated and used both to identify substances and to select substances for various uses.
		How can information be evaluated for bias? (Activity 5)				Although Web resources may have points of view and biases, it is possible to obtain information about the resources used to make materials, the advantages of these materials for solving problems, and the impact of these materials on society.

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## CHEMISTRY OF MATERIALS (continued)

Investigative Phenomena	Driving Questions	Guiding Questions	Activities	PE	Storyline
Even though we can't see atoms, they make up all the stuff around us.	Why do materials have unique properties?	How do atoms combine to form molecules? (Activity 6)	6, 7	MS-PS1-1	Substances have specific structures that can be modeled by arranging atomic models in various ways.
		How do the structures of particles in substances vary? (Activity 7)			A closer look at particles explains more properties, such as density and solubility.
Some substances, such as water, can exist as a solid, liquid, or gas.	What happens to the particles in a substance as it changes temperature or changes from one state to another?	How does the particle structure of matter explain the differences between solids, liquids, and gases? (Activity 8)	8, 9, 10	MS-PS1-4	At room temperature, some substances are solid while others are liquid or gas. Particle models, including models of the distances between particles and their motions, help explain the differences between the states of matter.
		What happens when gas particles are heated or cooled? (Activity 9)			Particle motion also helps explain the properties of a substance as temperature changes. Increased temperature indicates increased particle motion (kinetic energy). Decreased temperature indicates decreased particle motion (kinetic energy).
		What happens to the particles and temperature of a substance as it changes state? (Activity 10)			Transfer of thermal energy to a substance increases the substance's average kinetic energy (temperature) except during a change of state.

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### CHEMISTRY OF MATERIALS (continued)

Investigative Phenomena	Driving Questions	Guiding Questions	Activities	PE	Storyline
<p>Materials like plastics, metals, and glass are all useful, but they can also affect the environment.</p>	<p>How do a material's properties affect its uses?</p>	<p>How are plastics engineered for various uses? (Activity 11)</p> <p>How do the structures of plastics relate to their varied properties? (Activity 12)</p> <p>What are the benefits and trade-offs of different plastics? (Activity 13)</p>	<p>11, 12, 13</p>	<p>MS-PS1-3 MS-PS1-1</p>	<p>Plastics are synthetic materials that can be designed with a variety of structures and functions.</p> <p>The structure of a plastic causes it to have specific properties that allow plastics to be engineered to have a wide range of properties and, thus, uses.</p> <p>Synthetic materials, such as plastics, are made from natural resources and have many impacts, both positive and negative, on human health and the environment.</p>